RESISTANCE SCREENING CENTER 1983 STATUS REPORT

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Five hundred and seventy-seven seedlots were received for operational screening for fusiform rust resistance at the USDA Forest Service's Resistance Screening Center since February 17, 1982. A breakdown of the number of seedlots screened in operational (by cooperator), research, and developmental tests by year for all years of operation at the Resistance Screening Center is provided in Table 1.

As of January 10, 1983, screening of all seedlots received in 1981 and 18 seedlots received in 1982 have been completed. The design of these tests included six 20-tree trays of each seedlot; three in each of two runs. Runs were one day apart. Basidiospores were derived from a composite of aeciospores collected from 30 galls at 3 locations within predefined 2-4 county areas. Slash pine lots were inoculated with a spore suspension of 20,000 spores per milliliter; loblolly pine with 50,000 spores per milliliter.

All operational screening tests were analyzed using the following model.

$$Y_{jk} = u + S_j + R_k + SR_{jk} + e_{i(jk)}$$

where;

Y_{jk} = the observation on the i^{th} tray of the j^{th} seedlot in the k^{th} run

u = the general mean

S_j = the effect of the j^{th} seedlot

R_k = the effect of the k^{th} run

SR_{jk} = the effect of the interaction between the j^{th} seedlot and the environmental conditions of the k^{th} run

$e_{i(jk)}$ = the effect of the i^{th} tray within the j^{th} seedlot and the k^{th} run

Table 1.--Number of seedlots screened in operational, research, and developmental tests at the Resistance Screening Center in 10 years of operation.

Year [1]	operational		Research [3]	Developmental [3]	All Tests
	Client	No. Lots [2]			
1974	N.C. State Co-op	324			
	U. of Fla. Co-op	108			
	Texas Forest Serv.	110			
	Ala. For. Comm.	66			
	National Forest	50			
	Int. Paper Co.	30			
	WGFTIP	30			
	Westvaco	15			
	TOTAL	733	0	0	733
1975	N.C. State Co-op	322			
	U. of Fla. Co-op	54			
	Ala. For. Comm.	36			
	Texas Forest Serv.	12			
	TOTAL	424	108	45	577
1976	Ga. For. Comm.	233			
	National Forest	174			
	Int. Paper Co.	107			
	Texas Forest Serv.	52			
	N.C. State Co-op	49			
	U. of Fla. Co-op	20			
	Ala. For. Comm.	17			
	TOTAL	652	281	33	966
1977	National Forest	125			
	St. Regis	95			
	N.C. State Co-op	70			
	Ga. For. Comm.	53			
	Ala. For. Comm.	38			
	Int. Paper Co.	31			
	Westvaco	8			
	U. of Fla.	5			
	TOTAL	425	25	87	537
1978	Int. Paper Co.	121			
	SEFES	48			
	Ga. For. Comm.	32			
	Texas Forest Serv.	38			
	N.C. State Co-op	20			
	TOTAL	259	45	422	726

Table 1.--(con't)

Year	operational Client	No. Lots	Research	Developmental	All Tests
1979	Int. Paper Co.	47			
	Auburn U.	23			
	Ala. For. Comm.	16			
	TOTAL	86	67	55	208
1980	Ga. For. Comm.	171			
	Int. Paper Co.	152			
	Gulf State Paper	47			
	WGFTIP	36			
	Ala. For. Comm.	32			
	St. Regis Paper Co.	20			
	Texas A&M U.	6			
	TOTAL	464	285	139	888
1981	WGFTIP	83			
	USFS	179			
	TOTAL	262	161	424	847
1982	Ga. For. Comm.	63			
	Georgia-Pacific	47			
	Union Camp	40			
	USDA Forest Service	300			
	WGFTIP	85			
	Weyerhaeuser	42			
	TOTAL	577	259	29	865
1983 4/	TOTAL		169	43	212

1/ This is the year in which operational seedlots were received, and the year in which research and developmental tests were inoculated.

2/ Check seedlots were included in figures for operational lots received in 1974-1977, but not for those received in 1978-1981.

3/ Since experimental designs for research and developmental tests were most often different from the operational screening test design, the total number of trays in these tests was divided by 6 to obtain "seedlot equivalents."

4/ Figures include all research and developmental tests scheduled for inoculation in 1983 as of January 10, 1983.

For all tests, one observation consisted of percent galled per 20-tree planting trays. The analysis of variance for balanced tests is as follows:

Source	d.f.	Expected Mean Squares
Runs	(r-1)	$\sigma_w^2 + m\sigma_{RxS}^2 + ms\sigma_R^2$
Seedlots	(s-1)	$\sigma_w^2 + m\sigma_{RxS}^2 + mr\sigma_S^2$
Runs x seedlots (experimental error)	(r-1) (s-1)	$\sigma_w^2 + m\sigma_{RxS}^2$
Trays within runs and seedlots (sampling error)	rs(m-1)	σ_w^2
TOTAL	rsm-1	

where;

r = number of runs = 2

s = number of seedlots

m = number of trays per seedlot per run = 3

Missing trays were estimated by the average percent galled of the non-missing trays of the same seedlot in the same run and the degrees of freedom adjusted as in Yandle's 1978 "Statistical Analysis of Fusiform Rust Screening Tests."

The magnitude of the experimental error, σ_{RxS}^2, in this analysis for percent galled can be used as a measure of the accuracy and value of a greenhouse test.

Repeatability of seedlot means over runs was estimated using the following formula:

$$\text{Repeatability} = \frac{\sigma_S^2}{\sigma_P^2} = \frac{\sigma_S^2}{\sigma_S^2 + \frac{\sigma_{RxS}^2}{r} + \frac{\sigma_W^2}{m}}$$

where;

σ_P^2 = the estimated phenotypic variance of seedlot means

The concept of repeatability is designed to measure how consistent measurements on a trait are over time (Falconer, 1960; Turner and Young, 1969). Repeatability is the proportion of the total phenotypic variation which can be attributed to the variation among seedlot means. Assuming that variability among seedlots is the same in any year, repeatability can be interpreted in

this application as a measure of agreement between data from the two runs. For percent galled data, it can also serve as a measure of the accuracy and value of a greenhouse test.

RESULTS OF OPERATIONAL SCREENING TESTS COMPLETED BETWEEN FEBRUARY AND DECEMBER 1982

Seedlot differences were significant ($P \leq .05$) in all tests completed between February and December 1982 (Table 2). All tests showed an acceptable repeatability (.51 - .94).

All tests, with one exception, showed a non-significant experimental error. The test with the significant run by seedlot interaction had a repeatability of .71, indicating, that even with the significant interaction, seedlot differences could account for 71 percent of the total variation. One seedlot out of 53 seedlots in this test appeared to be ranked differently in the two runs. In an analysis of variance of this test, without this seedlot, the interaction was no longer significant, the experimental error dropped from 35 to 24, and the repeatability was .75. This indicates that the resistance information for the remaining 52 families is highly reliable.

DISCUSSION

Percent galled data indicated that Resistance Screening Center tests completed from February to December 1982 provided reliable information. Statistics for these tests were similar to tests in Resistance Screening Center operational years 5 through 8 (Hubbard, 1980 & 1981; Young, Hubbard, and Anderson, 1982).

Table 2.--Summary statistics for Resistance Screening Center operational screening tests completed between February and December 1982.

	Pine Species	
	Slash	Loblolly
No. tests	2	7
Avg. no. seedlots per test	36	31
range	19-53	16-54
total	72	215
Avg. test mean % galled	58	69
range	56-60	36-80
Avg. difference between highest and lowest seedlot means	63	38
range	52-74	24-58
% tests with sig. diff. between seedlot means ($P \leq .05$)	100	100
% tests with sig. diff. between run means ($P \leq .05$)	50	57
% tests with sig. Run x Seedlot interaction ($P \leq .05$)	50 [2/]	0
Avg. experimental error variation [1/]	25.9	1.43
range	0-35	0-9
Avg. sampling error [1/]	190	142.6
range	189-192	83-209
Avg. repeatability of seedlot means	.83	.68
range	.71-.94	.51-.81

1/ Average is weighted by degrees of freedom.

2/ Deletion of one seedlot from one test caused run x seedlot interaction to disappear, thus making % tests with sig. Run x Seedlot interaction ($P \leq .05$) for slash equal 0.

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